

REMARKS

In the last Office Action, the Examiner objected to the title of the invention as not being descriptive. The drawings were objected to under 35 U.S.C §1.83(a) as failing to show the subject matter cited in claim 10. Claim 10 was objected to as containing informalities. Claims 1, 11-14, 101, 103 and 104 were rejected under 35 U.S.C. §102(b) as being anticipated by European Patent No. 549,236 to Brezoczky et al. ("Brezoczky"). Claims 2-10 were rejected under 35 U.S.C. §103(a) as being unpatentable over Brezoczky. Additional art was cited of interest.

In accordance with the present response, independent claims 1 and 13 have been amended to further patentably distinguish from the prior art of record. Claim 10 has been canceled, thereby rendering the objection to claim 10 and the objection to the drawings under 35 U.S.C. §1.83(a) moot. Non-elected claims 15-100, 102 and 105-119 have been canceled without prejudice or admission and subject to applicants' right to file a continuing application to pursue the subject matter of the non-elected claims. New claims 120-130 have been added to provide a fuller scope of coverage.

The title of the invention has been changed to "NEAR-FIELD OPTICAL HEAD HAVING TAPERED HOLE FOR GUIDING LIGHT BEAM" to more clearly reflect the invention to which the claims are directed.

Applicants request reconsideration of their application in light of the foregoing amendments and the following discussion.

Brief Summary of the Invention

The present invention relates to a near-field optical head and to a method of manufacturing the near-field optical head.

As described in the specification (pgs. 1-7), conventional near-field optical heads have been unable to produce sufficient near-field light for recording information to and reading-out information from a recording medium with high speed, accuracy and efficiency. Additionally, conventional near-field optical heads have a rather large and complicated structure, thereby rendering them difficult to operate.

The present invention overcomes the drawbacks of the conventional art. Fig. 5 shows a near-field optical head 500 according to the present invention embodied in the claims. The near-field optical head 500 has a planar substrate 501 having a first surface, a second surface disposed opposite to the first surface, and an inverted conical or pyramidal hole 507 extending through the first and second surfaces and having at least one fine aperture 506 formed at an apex thereof and

disposed on the first surface. An optical waveguide 504 is disposed directly on the second surface of the planar substrate 501 for propagating light along an optical path. A mirror 508 is disposed in the optical waveguide 504 for bending in the direction of the fine aperture 506 the optical path of the light propagated through the optical waveguide 504.

In another aspect, the present invention is directed to a method of manufacturing a near-field optical head. With reference to Figs. 6A-6B, a planar substrate 501 is provided having a first surface and a second surface opposite the first surface. An inverted conical or pyramidal hole 507 having a fine aperture at an apex thereof is formed through the first surface of the planar substrate 501 (S101). An optical waveguide 504 is formed on the second surface of the planar substrate for propagating light along an optical path (S102-104). A mirror 508 is formed in the optical waveguide 504 for bending in the direction of the fine aperture the optical path of the light propagated through the optical waveguide 504 (S105-S016).

By the foregoing construction of the near-field optical head and corresponding manufacturing method according to the present invention, the optical waveguide can be arranged close to the fine aperture. Additionally, the mirror

and its location in the optical waveguide makes it possible to accurately focus the light propagated through the optical waveguide toward the fine aperture. Accordingly, the strength of light illuminated to the fine aperture and the intensity of near-field light produced from the fine aperture are increased as compared to the conventional art. Furthermore, the near-field optical head according to the present invention has high mechanical strength, a compact structure, and can be easily mass-produced.

Traversal of Prior Art Rejections

Rejections Under 35 U.S.C. §102 (b)

Claims 1, 11-14, 101, 103 and 104 were rejected under 35 U.S.C. §102(b) as being anticipated by Brezoczky. Applicants respectfully traverse this rejection and submit that amended independent claims 1 and 13 and claims 11, 12, 14, 101, 103 and 104 recite subject matter which is not identically disclosed or described in Brezoczky.

Independent claims 1 and 13

Amended independent claim 1 is directed to a near-field optical head and requires a planar substrate having a first surface, a second surface disposed opposite to the first surface, and an inverted conical or pyramidal hole extending through the first and second surfaces and having at least one

fine aperture formed at an apex thereof and disposed on the first surface. Claim 1 further requires an optical waveguide disposed directly on the second surface of the planar substrate for propagating light along an optical path, and a mirror disposed in the optical waveguide for bending in the direction of the fine aperture the optical path of the light propagated through the optical waveguide. No corresponding structural combination is disclosed or suggested by the prior art of record.

Brezoczky discloses an optical head comprising a planar substrate (i.e., slider) 31 (Fig. 3) or 51 (Figs. 4-5) having a conical hole 35 with a fine aperture 37 (col. 6, lines 1-22), and an optical waveguide (i.e., element denoted by reference numerals 46, 49, 61, 76 in Fig. 5) from which the planar substrate or slider is suspended by a flexure spring suspension 63 (col. 7, lines 43-53).

Thus in Brezoczky the optical waveguide connected to the planar substrate via a flexure spring suspension. In contrast, amended independent claim 1 recites that the optical waveguide is disposed directly on the second surface of the planar substrate. Stated otherwise, in Brezoczky the optical waveguide is not connected directly to the planar substrate, as recited in amended claim 1.

Amended independent claim 13 is directed to a method of manufacturing a near-field optical head and recites the step of disposing an optical waveguide directly on the second surface of the planar substrate. No corresponding structure is disclosed or described by Brezoczky as set forth above for amended independent claim 1.

Independent Claims 11, 12, 14, 101, 103, 104

Each of independent claims 11, 12 and 14 is directed to a method of manufacturing a near-field optical head which is not disclosed or described in Brezoczky. For example, independent claim 11 recites the step of "forming" an optical waveguide on the second surface of the planar substrate. Independent claims 12 and 14 recite the step of "bonding" the optical waveguide on the second surface of the planar substrate. In Brezoczky, the optical waveguide (i.e., element denoted by reference numerals 46, 49, 61, 76 in Fig. 5) is neither "formed" nor "bonded" on a surface of the planar substrate (i.e., slider 31 in Fig. 3 or 51 in Figs. 4-5). Instead, in Brezoczky the optical waveguide is connected to the planar substrate via a flexure spring suspension, as set forth above for amended independent claim 1.

Independent method claims 101, 103 and 104 also recite combinations of steps which are not disclosed or described by Brezoczky. For example, claim 101 recites a combination of steps which requires the specific manner of forming a light propagation member, a light introducing part, and a light reflection layer. Claims 103 and 104 recite the combination of steps which require the specific manner of forming a tapered hole, disposing a metal film, forming a convex surface portion, and bonding a light introducing part.

Should the Examiner maintain the Section 102(b) rejection of claims 11, 12, 14, 101, 103 and 104 based on Brezoczky, applicants respectfully request that the Examiner specifically point out the method steps in Brezoczky corresponding to the method steps recited in claims 11, 12, 14, 101, 103 and 104.

In the absence of the foregoing disclosure recited in amended independent claims 1 and 13 and independent claims 11, 12, 14, 101, 103 and 104, anticipation cannot be found. See, e.g., W.L. Gore & Associates v. Garlock, Inc., 220 USPQ 303, 313 (Fed. Cir. 1983), cert. denied, 469 U.S. 851 (1984) ("Anticipation requires the disclosure in a single prior art reference of each element of the claim under consideration"); Continental Can Co. USA v. Monsanto Co., 20 USPQ2d 1746, 1748 (Fed. Cir. 1991) ("When more than one reference is required to

establish unpatentability of the claimed invention anticipation under § 102 can not be found".); Lindemann Maschinenfabrik GmbH v. American Hoist & Derrick Co., 221 USPQ 481, 485 (Fed. Cir. 1984) (emphasis added) ("Anticipation requires the presence in a single prior art reference disclosure of each and every element of the claimed invention, arranged as in the claim").

Stated otherwise, there must be no difference between the claimed invention and the reference disclosure, as viewed by a person of ordinary skill in the field of the invention. This standard is clearly not satisfied by Brezoczky for the reasons stated above. Furthermore, Brezoczky does not suggest the claimed subject matter and, therefore, would not have motivated one skilled in the art to modify Brezoczky's near-field optical head to arrive at the claimed invention.

In view of the foregoing, applicants respectfully request that the rejection of claims 1, 11-14, 101, 103 and 104 under 35 U.S.C. §102(b) as being anticipated by Brezoczky be withdrawn.

Rejection Under 35 U.S.C. §103(a)

Claims 2-9 were rejected under 35 U.S.C. §103(a) as being unpatentable over Brezoczky. Applicants respectfully traverse this rejection and submit that the teachings of

Brezoczky do not disclose or suggest the subject matter recited in claims 2-9.

Brezoczky does not disclose or suggest the subject matter recited in amended independent claim 1 as set forth above for the rejection under 35 U.S.C. §102(b). Claims 2-9 depend on and contain all of the limitations of amended independent claim 1 and, therefore, distinguish from the reference at least in the same manner as claim 1.

Moreover, there are separate grounds for patentability of several of dependent claims 2-9.

Claim 2 includes the additional limitation that the optical waveguide extends into the inverted conical or pyramidal hole. The Examiner contends that the structural feature recited in claim 2 is deemed to be obvious to one of ordinary skill in the art merely because the optical waveguide "could be made in any desirable sizes.....an formed at any suitable locations on the optical head."

Claims 3-7 are directed to the specific structure of the inverted conical or pyramidal hole. With respect to these structural features, the Examiner merely contends that such features are obvious because they are "old and widely used in the optical recording art".

Applicants vigorously disagree with the Examiner's contention and conclusion of obviousness with respect to the subject matter of claims 2-7.

In order to support a claim rejection based upon obviousness under 35 U.S.C. §103, the Examiner must provide an evidentiary basis establishing the obviousness of each modification. The Examiner may do this by citing a reference which directly establishes this obviousness, or, the Examiner may otherwise set forth a line of reasoning consistent with and motivated by the cited art establishing that such modifications would have been obvious. Mere speculation or conclusory allegations are simply inadequate to meet this burden. There must be some teaching, reason, suggestion, or motivation found in the prior art references to make a combination which renders an invention obvious within the meaning of 35 U.S.C §103. See, e.g., Symbol Technologies, Inc. v. Opticon, Inc., 935 F.2d 982, 989, 18 USPQ2d 1885 (Fed. Cir. 1991).

In order to set forth a prima facie case of obviousness, the Examiner must not only demonstrate that this teaching exists in the prior art, but that it would teach all limitations of the claim. Stated otherwise, in rejecting a claim as obvious under 35 U.S.C. §103, the Examiner cannot simply rely on a reference that teaches some limitations of

the claim, and make mere conclusory allegations that the combination teaches others as well. In the instant case, the Examiner has not met his burden of establishing a prima facie case of obviousness with respect to the specific structural limitations recited in claims 2-7.

For example, claim 2 recites that the optical waveguide extends into the inverted conical or pyramidal hole of the planar substrate. In Brezoczky, the only reference cited by the Examiner to reject claim 2, the planar substrate is suspended from the optical waveguide via a flexure spring suspension (Fig. 5) as set forth above for amended independent claim 1. In this regard, following the Examiner's conclusion of obviousness, how would the size, shape, angle and/or location of the optical waveguide in Brezoczky be modified so that it extends into the conical hole of the planar substrate? Even if possible to make such modifications, the Examiner has not cited any reference which directly establishes the obviousness of such modification, nor has the Examiner set forth a line of reasoning consistent with and motivated by the cited art establishing that such modifications would have been obvious.

With respect to claims 3-7, applicants note the Examiner's reference to Ito et al. (USPN 6,304,527) on page 7, lines 12-13 of the Office Action. However, it is unclear how

the Examiner proposes to rely on Ito et al. in the claim rejection. Should the Examiner continue to rely on the reference to Ito et al. in any manner to reject any of the pending claims, applicants respectfully request that the Examiner specify the teaching in Ito et al. being relied upon and how the Examiner proposes to combine Ito et al. with the reference to Brezoczky to arrive at the invention recited in claims 3-7.

In view of the foregoing, applicants respectfully request that the rejection of claims 2-9 under 35 U.S.C. §103(a) as being unpatentable over Brezoczky be withdrawn.

Applicants respectfully submit that the prior art of record also does not disclose or suggest the subject matter recited in newly added claims 120-130.

New independent claim 127 is directed to a near-field optical head and requires a planar substrate having a first surface, a second surface disposed opposite to the first surface, and an inverted conical or pyramidal hole extending through the first and second surfaces and having at least one fine aperture formed at an apex thereof and disposed in the first surface. Claim 127 further requires an optical waveguide for propagating light along an optical path, the optical waveguide being formed on the second surface of the planar substrate so that the optical waveguide and the planar

substrate form an integral structure, and a mirror disposed in the optical waveguide for bending in the direction of the fine aperture the optical path of the light propagated through the optical waveguide. No corresponding structural combination is disclosed or suggested by the prior art of record. For example, as set forth above for amended independent claim 1, in Brezoczky the optical waveguide and the planar substrate are connected together via a flexible spring suspension and, therefore, the optical waveguide is not formed on the second surface of the planar substrate so that the optical waveguide and the planar substrate form an integral structure, as recited in claim 127.

New claims 120-122, 123-126 and 128-130 depend on and contain all of the limitations of independent claims 1, 11-14 and 127, respectively, and, therefore, distinguish from the prior art of record at least in the same manner as claims 1, 11-14 and 127.

Moreover, there are separate grounds for patentability of new dependent claims 120-122, 123-126 and 128-130 which are directed to the specific structural relationship between the optical waveguide and the planar substrate (claims 120, 122, 129, 130), the specific type of near-field optical head (claims 121, 128), and the specific step of forming, bonding or connecting the optical waveguide

to the planar substrate (claims 123-126). No corresponding structure and steps are disclosed or suggested by the prior art of record.

In view of the foregoing amendments and discussion, the application is believed to be in allowable form. Accordingly, favorable reconsideration and allowance of the claims are most respectfully requested.

Respectfully submitted,

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Date